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Technical Report

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MECHANIZATION STUDY
OF THE
REDSTONE SCIENTIFIC
INFORMATION CENTER,
REDSTONE ARSENAL, ALABAMA

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ABSTRACT

The Rockwell Scientific Information Center (RSIC) is engaged in a major effort to mechanize its Library operations using IBM 7010, 1460, and 1401 computers. The total integrated effort is known as ALPHA (Automated Literature Processing, Handling and Analysis System), which is a serial system operating on a batched transaction basis. The system is in first-generation stage of development. Mechanization of RSIC is being developed under contract by General Electric. At present, the mechanized routines for the acquisition and circulation of books, periodical control, and the Patron File are fully operational. RSIC also receives NASA tapes and utilizes them in literature searches. In addition, NASA headquarters is sponsoring an information automation project in which RSIC is participating. This is a prototype test of the current selective dissemination of information based on IBM's SDI programs. Several programs are being planned or developed for mechanization in addition to the above.

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I. SUMMARY

The Redstone Scientific Information Center (RSIC) is engaged in a major effort to mechanize its Library operations by computer. The total integrated effort is known by the acronym ALPHA (for Automated Literature Processing, Handling, and Analysis System). In its present stage, it is known as ALPHA-1, the "1" standing for "first generation." At present fully operational and in use are the mechanized routines for the acquisition and circulation of books, serials control, including ordinary renewing, routing, claiming, binding, and recording holdings inventorying of classified documents, subject headings for books, and the Patron File which includes identifying information about each patron, periodicals routed to him, his security clearance, and his need-to-know certification. Provisions are included for interest profiles at a later date. Mechanization of RSIC is being developed by a combination of in-house effort and a contract with the General Electric Company.

The organization of RSIC is shown in Appendix A. RSIC serves the Army Missile Command and the Marshall Space Flight Center (both located in Huntsville, Alabama) and their on-site and local contractors. This is a potential user group of about 40,000 people although the actual number of active users is 8,600. RSIC only serves off-site users through

interlibrary loan, about 25 items per month. Library services may be obtained by personal visit or by use of all -purpose library request form.

At present RSIC contains 110,000 books and bound periodicals and adds about 27,600 each year. The circulation rate for books is about 47,000 per year. RSIC receives 2,400 periodical subscriptions with an annual increase of about 250 new subscriptions. The annual circulation of periodicals is 36,000. The technical document collection contains 732,820 reports; about 300,000 are full-size, the remainder in microform. About 42,000 full-size and 72,000 microform copies are added yearly. The annual circulation of full-size documents is 25,500. No circulation records are available for microform. All COSATI subject categories are represented in the RSIC collection.

RSIC receives NASA tapes and utilizes them in literature searches. In this search program as now designed, up to 30 inquiries of not over 350 terms with full logic are batched for running once a week on the IBM 7010.

NASA Headquarters is sponsoring an information automation project in which RSIC, as the information service group for the Marshall Space Flight Center, is participating. This is a prototype test of the current selective dissemination of information based on IBM's SDI

programs. This test includes about 500 sample technical profiles for personnel in Washington and field installations. About 90 local participants are involved.

II. MECHANIZATION

1. CHRONOLOGY

In 1962, a few months after the present Director of RSIC was appointed, a study of mechanization was initiated.

From May to November of 1963, Phase I of a study of the problem of automating the operation of RSIC was made by General Electric.

Early in 1964, the routines for periodicals were mechanized. Later, the book ordering and receiving, book circulation, and Patron File routines were developed. In late 1964, the NASA tape search was added.

2. DESCRIPTION OF PROCESSES

(1) Input Procedures

1. Ordering and Receiving^{*}

(1) When a patron request card (see Figure 1) is received in the circulation section, the circulation librarian determines if: 1) the item requested is not available

* Extracted from Automated Book Ordering and Receiving, by E. F. Miller, B. W. Lee, and J. D. Nilsson, Special Libraries, February, 1966.

FIGURE 1

Library Request Form

LIBRARY REQUEST FORM

REQUESTED BY _____ MAIL ADDR _____

SOCIAL SECURITY NR _____ PHONE _____ DATE _____

AUTHOR(S) _____

TITLE _____

EDITION	MAGAZINE TITLE	REPORT NUMBER(S)
PUBLISHER		
CITY	VOL	ISSUING AGENCY(S)
DATE	PAGE THRU	DATE CONTRACT NR
CALL NR	DATE	CLASSIFICATION

REFERENCE OBTAINED FROM _____

LC CARD NR _____ QTY TO BE ORDERED _____ UNIT PRICE _____

VENDOR _____ CHECKED BY _____

USE 1-6634
 1-6634 FORM 29, WHICH MAY BE USED

for circulation, 2) the item is not on order, 3) the item cannot be recalled, 4) the item is not flagged as reserve, and 5) the item is not outside the scope of RSIC. When all of these conditions are met the circulation librarian adds to the request card any other information readily available, such as LC classification number, complete title, author, and so on. Then the request card is forwarded to the acquisition section.

The first step in the processing cycle for the acquisition section is to determine exactly what is wanted. The acquisition librarian's decision is based on normal new title selection procedure or on a specific request by the patron. Once it is decided to add the book to the holdings, the librarian completes the original request card by adding the publisher, address, quantity to be ordered, unit cost, LC card number, and the vendor. Request cards are grouped by vendor and placed in the to-be-ordered file.

(2) Daily, the typing calculator operator prepares the purchase orders, one for each vendor. The purchase order itself is simply a pin-fed multipart continuous form. The use of the continuous form reduces significantly the time taken to insert and align paper in the typewriter.

(3) The heading on the purchase order is prepared automatically by inserting into the typing calculator a small deck of keypunched cards that contain information about the vendor (name, purchase order number, vendor's address, and so forth). The typing calculator automatically reads this information and types it in the proper area at the top of the form.

(4) Using a request card as a source document, the operator types, in the proper order, the information required for ordering a requested item. The typing calculator automatically spaces for the operator. The operator then types, to the side, where information does not appear on the purchase order, any additional information required for the order, such as requesting-patron identification. The result of this one-time typing

is the completed entry of a requested item on a purchase order, plus a set of ordering input transaction cards automatically created by the typing calculator. These cards are used by the computers to update the appropriate computer files. (See Figure 2)

(5) The machine automatically extends and totals the amount of each purchase. If a monetary limitation has been imposed, the operator may check at any time to see if the limit has been reached. The operator may also key in the next item to see if it will overextend the amount without disrupting any total that has been accumulated. Such trial balances are typed to the side of the purchase order.

(6) When ordering is complete, the operator forwards the purchase order and the key-punched ordering cards to the librarian in charge of the ordering and receiving section for checking. Copies of the purchase order are separated and distributed to the vendor, purchasing department, and accounting office. The punched cards are forwarded to the computation center.

(7) The ordering and receiving section receives an "On Order and Received Report" weekly, with daily supplements, from the computation center. Copies of the Report are sent to the acquisition and circulation librarians. The Report is arranged by title, which is used at RSIC in place of a main entry arrangement, and it reflects the status of all titles that have been ordered or received but not yet cataloged. Decks of punched and printed cards (See Figure 3), each representing an item ordered, accompany the Report. The cards are used for receiving, cataloging, and distributing the book when the order has been filled. Each item on the Report is cross-referenced to its cards by an arbitrary number assigned to it automatically by the computer. The cards are placed in numerical sequence by the computer and are filed according to these numbers without any manual sorting or rearrangement.

(8) As each book is received from a vendor, it is checked against the "On Order and Received Report". After verification, the receiving, cataloging, and

FIGURE 2
Transaction Cards

[illegible]

FIGURE 3
RSIC Patron Card

Section 1 (To Be Completed By Individual)		
LAST NAME	GIVEN NAMES	TITLE OR RANK (Dr, Col, etc)
SOCIAL SECURITY NR	PHONE NR	EXTENSION
ORGANIZATION SYMBOL	BL NR	ROOM NR
BUSINESS MAILING ADDRESS (if Applicable)		
SECURITY CLEARANCE		CITIZENSHIP (Specify Country)
PATRON TYPE (Check One) <input type="checkbox"/> Army Contractor <input type="checkbox"/> NASA Contractor <input type="checkbox"/> Military <input type="checkbox"/> CS NASA <input type="checkbox"/> CS Army <input type="checkbox"/> Other		IF CONTRACTOR STATE COMPANY CONTRACT(S)
I understand I am responsible for any material released to me. I will safeguard classified documents in accordance with current security regulations and clear RSIC prior to termination.		
DATE		SIGNATURE

Section 2 (Contractors Only)	
Above individual has security clearance as shown. This employee will be required to clear RSIC when need for access is terminated.	
DATE	SIGNATURE (Company Security Officer)

AMSMI-R-10, 1 Sep 65 RSIC PATRON CARD
(See reverse for NEED-TO-KNOW)

Front

Section 3 (Sponsor or Supervisor)
NEED-TO-KNOW (Specify subject categories in accordance with MICOM Reg 705-7)

APPROVED. The individual named on reverse of this card is authorized (access) (loan of material). Security clearance as shown on reverse and need-to-know as indicated above are certified.

DATE SIGNATURE AND ORGANIZATION (Approving Auth.)

Back

distribution cards are pulled from the file. Receiving information, such as quantity, price, date received, and so on, is written on the receiving cards, which are then forwarded to the typing calculator operator for keypunching and finally to the computation center for processing.

(9) Catalog and patron mailing cards are placed in the book and travel with it to the cataloging section. The cataloger is able to tell by the absence or presence of an LC classification number on the catalog card whether the item is a new title or an additional copy of a title already in the collection. When the book has been cataloged, the catalog card is forwarded to the computation center for processing.

(10) The distribution card follows the book to the circulation desk, where the book is checked out to the patron whose name appears on the card. Information on the distribution card includes the patron's name, mailing symbol, and building number. The card is taped to the book and both are mailed to the patron. This action completes the ordering, receiving, cataloging, and distribution cycle.

2. Circulation

(1) Each book that is available for circulation contains an IBM card showing type of material, call number, copy number, author, abbreviated title, and security classification. When a patron wishes to borrow a book, the IBM card is put into the keypunch and punched for type of loan and Julian date. The social security number of the patron, his last name and two initials are added. The card is then duplicated. One copy is placed in the book pocket; the other copy goes into the day's accumulation of cards which are sent to the computation center at the end of the day.

(2) When a book is returned, a cancellation record on the loan is keypunched into the card in the book pocket by overpunching in column 1. The first part of the card (the information through security classification) is then duplicated into a new card which goes into the book pocket ready for the next circulation transaction (column 1 is punched, not duplicated on new TX cards).

(3) When a new book requested by a patron comes through from the cataloging section, the card which accompanies it is used to serve as an address label and the book is put into the mail to the patron.

3. Periodicals

A new periodicals system has been designed and is expected to be operational by summer. The current system is described below.

(1) A subscription to a periodical is requested on a library request form. If a decision is made to order, a keypunch operator punches the information and the new subscription cards are added monthly to the renewal list.

(2) If a subscription is up for renewal and a decision is made to renew it, the information goes to the key-punch operator who punches the cards for the renewal record. These, with any new subscription cards, go to the computation center. (Renewal lists are prepared for review or a computer run.)

(3) As periodical subscriptions are processed, the following information is added to the Periodical Master File: a control number which serves for listing periodicals in alphabetical order, title, publisher, vendor, date of purchase, language,

subject field, frequency, cost, binding instructions, holdings, gaps in holdings, information about title changes, volume changes, etc.

(4) The information in the Periodical Master File is used to produce several different printouts.

4. Patron File

(1) A person wishing to use the Library fills out a RSIC Patron Card (see Figure 2). If he is an in-house contractor, he will get the card signed by his Division, Laboratory, or Technical Branch Chief. If he is an out-of-house contractor, he submits the form through the contracting office's representative.

COSATI categories are used as the need-to-know subjects for Army Missile Command, NASA, and contractor employees. These categories are typed on the back of the categories are typed on the back of the card. The user returns the completed card to the Library where it is checked for the authorization signature.

(2) Once each week, on Friday afternoon, the information on the new patron cards is keypunched in the Library. The keypunched cards are proofread manually and then sent to the computation center.

(3) When a man leaves the base, he must be cleared through the Library. At this time, a delete or change form is filled out and sent to the keypunch operator. The punched cards containing this information are sent to the computation center with the new patron cards for the week.

(4) Upon request a patron has his name added to periodical routing lists. Cards punched contain Social Security number, name and control number of periodical wanted. These cards are sent with others representing changes to the Patron Master File.

(2) Outputs

1. Ordering and Receiving

The computer prints out a weekly On Order and Received Report (see Appendix B-1), with a daily supplement. This report shows the order record of all books (alphabetized by title) on order or received but not yet cataloged.

This weekly cumulated report is sent to the ordering and receiving section each Monday, accompanied by a deck of three or more punched and interpreted cards for each title ordered the previous week. Each item is cross-referenced to its cards by an idiot (ordering sequence) number assigned by the computer. The cards are placed in numerical order by the computer and, when received in the ordering and receiving section, are filed in that order until the books are received.

In addition to the On Order and Received Report, the following printouts are also produced from the input of the Ordering and Receiving Section: (1) A quarterly printout of orders outstanding for six months. This is used to send lists to vendors requesting reports on items outstanding. If no report is received on an item within a stated period,

the order is cancelled, requestor informed, the item deleted from the on order record and a new order effort initiated.

(2) A complete financial record, each month, showing the current condition of the acquisitions fund and the details of the amount of orders outstanding with each vendor.

2. Circulation

A weekly printout of the updated circulation list, (Appendix B-2) is produced in two parts, showing call number, author, and short title of the book; codes showing type of material, security classification, type of loan, recall notices and date loaned; and the social security number, name and brief address of the borrower for each item. One list is in alphabetical order by borrower's name. The other is in alphanumeric order by the call number of the books. The name list is consulted when a man is leaving the base, in order to make certain that he has returned all borrowed books. It is also consulted when a borrower wants to know what books are charged out to him at any given time. The call number list is used to locate a copy of a book for recall, to learn how many copies are available for loan, etc.

Information from the circulation records is also used to generate overdue and recall notices based on date since

loan, other patron needs, and need for recall for other purposes.

3. Periodicals

(1) The Periodical Master File (Appendix B-3) is printed out monthly and contains the basic data from which all listings are derived. New subscriptions, until the effective date of receipt, appear in the on order (renewal order) list, but not in the Master File.

(2) Monthly "review list" for renewals. This shows periodical titles five months in advance of their expiration date; government publications, services, and newspapers are shown three months in advance of expiration date.

(3) Verification list of titles to be renewed and new titles to be added. About a week elapses between the time the keypunched cards go to the computation center and the Verification List is returned.

(4) Monthly binding list. This is received during the first week of each month. It contains the correct binding title for each item, subject, binding schedule, physical makeup of journal, binding instructions, location of index, and any special instructions. The binding list is turned over to the binding contractor who checks the shelves to see if the volumes are ready to go, pulls them, and sends them off for binding.

(5) A yearly printout of the cost of foreign periodical renewals. This is used to check against the foreign balance-of-payment requirement imposed on the Library and to estimate coming year contrast (agent) requirements.

(6) A monthly list showing the total active files and number of actual subscriptions, by journals, services, and newspapers. Routing requirements are also shown.

(7) A semiannual list of holding is produced on mats for printing and distribution to the various offices and patrons.

(8) Claim cards. These are printed-out lists, by vendor, showing items not received. This information is compiled from the periodical check-listing cards which are returned from the Periodicals Department.

(9) Using information drawn from the Patron File and the Periodical File, the computation center generates routing slips and a routing list for each number of each periodical available for routing. This shows the title and copy number of the periodical, the organization and building in which each man on the list is located, the name of each man, opposite his location, and a place to record the date he received the periodical. It is possible to place a given name at either the head or the foot of the routing list.

4. Patron File

The Patron File (Appendix B-4) is printed out in updated form each week. It is produced in two parts. One part is arranged in alphabetical order by patron's name. The other part is in numerical sequence by social security numbers. Each list contains the following information: patron's name, social security number, office symbol or mailing address, security clearance, type of patron (NASA, Army, or contractor), citizenship, company name, building, room, and phone numbers, need-to-know type and categories, and comments. The book circulation staff use the patron list

to verify a borrower's name, location, clearance, need-to-know and routing schedule. In the Document Section, the Patron File is used to locate borrowers.

3. ACTIVITIES BEING PLANNED OR
DEVELOPED FOR MECHANIZATION

RSIC has programs planned or under development to extend ALPHA to mechanize the following processes:

- (1) Entering all serials into the Periodicals File, where at present only the journals are entered.
- (2) Language control file to control cataloging input for books and reports.
- (3) Ordering and receiving technical reports on distribution or special request.
- (4) Preparation of a catalog to the book collection in printed-out book form. This would gradually eliminate the card catalog and is expected to be completed by FY 1967.
- (5) Automated preparation and distribution of the weekly list of new acquisitions.
- (6) Literature and reference searches from the RSIC book and document collection. (A system must be worked out that will avoid duplication of information between RSIC document tapes and the tapes they receive from NASA, DDC, etc.)

- (7) Circulation of items from the documents collection.
- (8) Development, jointly with the University of Alabama, of a periodical information program that can contain records from multiple libraries and will be easily convertible from one machine to another.
- (9) A program for document inventory which will include downgrading instructions in the record.
- (10) A combined SDI application covering the three major data sources is under study.

The General Electric contract with RSIC will be completed early in FY 1967.

The NASA Search System has been modified for operation on the IBM 7010. The advantages of converting it for running on the IBM 7094 were considered and rejected. It will eventually be merged by RSIC with the document bibliography master built in the ALPHA system and hopefully with DDC supplied tapes. Conversions of format will make possible a single search file for retrospective interrogation.

With the advent of multiple processing computers, RSIC will probably put the ALPHA system on-line. A gross system design for such a change has been produced and is being amplified as one part of the AMC sponsored NAPALM project.

III. PROGRAM SYSTEM DATA

The ALPHA System is a serial system operating on a batched transaction basis. It is currently operating on IBM 1401, IBM 1460, and IBM 7010 computers. The 1400 series equipment is peripheral only. There is very little use of random access and no remote inquiry devices. The second generation, parts of which are in the experimental planning stage, will use remote inquiry and will require large, random access storage.

The system requires only information about the patron and about the holdings, or information carriers, whether they be books, periodicals, documents, etc.

The detailed system analysis of what was actually done in the Library showed that the traditional distinction between the three types of information carriers mentioned was appropriate in at least early forms of mechanized systems. There were significant differences, particularly between periodicals and the other two types. The system, therefore, is composed of four basic parts: A master file of information about the patron and master files of information about the three primary kinds of information carriers. Authority type controls of language are also involved.

1. FILES

(1) Patron File

For each library patron at RSIC, his social security number (SSN), name, address, type of patron, organization, building location, mailing symbol, telephone number, periodical routing requirement, security clearance, need-to-know, and interest profile are stored. The records are in SSN sequence.

(2) Periodical File

Information in this file is divided into four categories:

- . Bibliographic -- common data related to the title such as language, publisher, frequency.
- . Holdings -- list of currently held issues and volumes. The RSIC holdings notation is patterned after the Union List of Serials notation, but is more explicit. Missing numerals in this notation indicate missing items.
- . Binding -- color, size, and related data on binding.
- . Ordering and disposition -- dates, cost, vendor, and related renewal data.

Bibliographic data are recorded once. All other data are stored in multiple records sequenced by the agency ordering or using the periodical. All records pertaining to a single title are tied together by a common periodical control number.

(3) Book File

The Book File contains bibliographic data for each copy of each item. Each record contains the Library of Congress number, copy number, number of copies, indicator code, cataloger initials, data element code, action code, and data element. Figure 4 shows a list of data elements and their codes. Figure 5 is a sample of input.

(4) Document File

In many ways, the document record will be in essentially the same format as the records on the book master. Since there are some differences in the elements of information and in many parts of the processing, documents are separated from books at this time although a single file may be appropriate in a later version. Particularly likely is some single retrieval file.

Presently, the Document file is expected to contain number (file), date, corporate author, title, authors, issuing agency, pagination, form, alternate numbers, contract, security data, use data, receipt data, and descriptors.

In addition to the four master files, a number of intermediate files are maintained. Some are made up of subsets of information

FIGURE 4

Data Element Codes and Their Meaning

<u>Data Element Code</u>	<u>Type of Data</u>
A01 - A99	Authors
B01 - B99	Titles
C01 - C99	Corporate Authors
D01 - D99	Corporate Addresses
E01 - E99	Editors
F01 - F99	Compilers
G01 - G99	Translators
H01 - H99	Illustrators
I01 - I99	Place
J01 - J99	Publisher
K01 - K99	Date
L01 - L99	Language
M01 - M99	Series
N01 - N99	Variant Title Notes
O01 - O99	Informal Notes
P01 - P99	Subject Headings
Q01 - Q99	Cosati Subject Category List
R01 - R99	Volume
S01 - S99	Pagination
Abb -	None
Pbb -	Subject Headings

NOTE: Error Message when Data Element Code in TX Record is not one of the above will read - INVALID DATA ELEMENT CODE.

FIGURE 5
Raw Input Date

Cataloger's Action Call Copy No. of Special
Initial Code No. No. Copies Indication

1	E	181	W881	1928	+	0001	0001	+
---	---	-----	------	------	---	------	------	---

[illegible][illegible]

from the master files in a condensed form more suitable for the individual data processing tasks. Frequently, these also contain certain generated information not available from the master files directly. Library transactions, i. e., renewals of subscriptions and the like, are stored in intermediate files until they are posted to the appropriate master files. These also include "in-process" files of items that have been ordered and not received or items awaiting cataloging.

(5) Book Inventory File

The Book Inventory File is essentially a combination of the traditional library shelf list and the traditional circulation record but does not contain the borrower's name. This file contains an entry for every title. Disposition, addition, and load information is posted to the file.

Each record contains the Library of Congress number, author, title, number of copies, quantity on hand, number of times circulated, date first circulated, and individual copy fields. The file is in sequency by Library of Congress number.

(6) Book Circulation File

This file contains an entry for every copy of every title that is on loan. Each record contains the Library of Congress number,

lost book indicator, patron name, patron number, circulation date, type item (book, bound periodical, etc.), security classification, type loan, mail address, phone, flags and dates for renewal, recall, automatic renewal and interlibrary loan, no patron flag, print flag, building number, type employee, and contractor codes. The file is in sequence by Library of Congress number.

(7) Subject Heading File

This is a file of valid 70-character subject headings. Temporary valid subject headings are flagged until a decision is made either to enter them as a permanent part of the file or discard them. In the future this file will become part of the Language Control Module now being programmed.

(8) Book Search File

In this file, books are indexed by their subject areas. The file is inverted; that is, it consists of subject headings arranged in sequence, each followed by up to twelve call numbers.

(9) Master On-Order File

This file is the record of the status of all book orders between the time the order is made until the book is cataloged and ready for use. Each record contains fields for request number,

item number, purchase order number, author, book title, publisher address, quantity ordered, unit cost, L.C. classification and card numbers, patrons' agencies, date of order, and comments.

(10) Renewal Master File
Renewal Items Master File

These two files are used to facilitate processing renewal of periodicals. Each record in these two files contains the periodical control number, effective date of subscription, type item, vendor, country, addressee, and purchase order control numbers. The two files differ only in that the Renewal Master contains both renewals and cancellations whereas the Renewal Items Master contains only the periodicals that are to be renewed.

2. PROGRAMS

At present, the system is composed of 11 functional modules, some of which are in their second versions. Patron Control, Periodical File Maintenance and Renewal, Periodical Routing, Books Ordering and Receiving, Book Circulation, and Subject Heading Update are operational. The modules for Document Acquisition, Document Circulation, Book Cataloging, Search, and Language Control are being designed or implemented.

All input and output mentioned in the following descriptions are performed by the 1401, using magnetic tape to communicate with the 7010. The 1460 is used to prepare output reports.

(1) Patron Control Module

The Patron Control Module maintains a central control file of all relevant patron data required by the other modules of ALPHA and displays such data for library use.

Transaction cards for adding or deleting data from the Patron File are edited for validity and sorted by patron social security number (SSN), card number identifying the card contents, and action code indicating action on a new or previously known patron. Invalid cards are punched and interpreted for correction.

Sorted valid transactions are posted to the Patron File. A second copy of the file is generated, sorted by name, and printed. A Patron Transaction Monitor is also produced, showing a line item entry for each input transaction with appropriate processing or error messages, followed by a page of statistical summary. Transactions not processed because of errors are also punched to simplify their resubmission. Totally deleted records are listed on 5 x 8 cards for review and record. All changes to elements of patron data that may affect need-to-know requirements

result in the production of Revalidation Notices on 5 x 8 cards addressed to the chief of the office employing the patron.

(2) Periodical File Maintenance and
Renewal Module

This module maintains a central control file for renewal, cancellation, holdings, and binding of periodicals; it runs twice a month.

The expiration dates and binding schedules of all items in the Periodical Master File are examined. All items due for renewal are added to the Renewal Master File and are printed for review by the Library. An error list is also printed. Items due for binding are printed for action by the Library; binding data errors are also printed.

Renewal and cancellation transaction cards are read; sorted by control number, card number, and action code; and posted to the Renewal Master File. All renewals are recorded in the Renewal Items Master File. The renewals and cancellations are printed in separate lists. Two sets of cards are punched for action to the Periodical Master File; one set contains normal changes and the other set contains changes to be made at some future date, such as a change of vendor when a subscription runs

out. The Renewal Items Master File is sorted by effective date, type item, vendor, country, addressee, and control number; lists are made of items on purchase order and on requisition. A count of various categories is printed. Renewals are sorted by control number, merged with manual orders and renewals received, and posted to a Master On-Order File. Lists are printed showing orders received, undelivered items, the orders to date, and errors.

Transactions for the Periodical Master File are sorted by control number, card number, and action code. Errors and a list of new holdings are printed. Edited transactions are posted to the Periodical Master File. The updated file is printed. The Periodical Routing Master File (List) is generated for use with the Periodical Routing Module. This file (list) shows all routing requirements by control number and short title.

(3) Periodical Routing Module

The Patron Routing File (a list of patron names, their addresses, and the periodicals they wish to receive) is sorted by periodical control numbers. This file is matched against the Periodical Routing Master File (a list of periodicals and the number of copies of each). A routing slip for each copy of each

periodical is printed for attachment to each issue upon receipt.

In addition, a list of errors, in SSN sequence, and reference lists for Library use are printed.

(4) Books Ordering and Receiving Module

This module maintains a central control file for the books that have been ordered by the Library.

Transactions, that is, new books being ordered, books received, books cataloged, and order cancellations, are read and checked for validity. Errors are printed and punched on cards to be corrected and resubmitted. Valid transactions are written on tape, merged with recycled transactions, and sorted by control number and card type for posting to the Master On-Order File. A "new order" card causes a complete new record to be added to the file and receipt cards, cataloging cards and patron address cards to be punched and held at the Library until the order is filled. A receipt card adds to the file such information as quantity received, date, cost, voucher number and type item. A catalog card or cancellation card causes a record to be dropped from the file. Errors are printed, and transactions that are not processed are saved to be recycled at the next computer run. An option control card may be used to reset the control (idiot) number

for new orders to zero. A copy of the file in print format is saved on tape at the Computation Center Tape Library.

Several reports are produced automatically as a by-product of updating: a list of cancelled items by title, voucher register, financial report, and workload summary.

The social security number of the patron requesting an item is submitted to the computer when an order is placed. These numbers are matched against the Patron File. Unmatched numbers are punched and printed for correction. Matched numbers generate patron transmittal cards punched to be attached to the book for mailing.

(5) Book Circulation Module

The Book Circulation Module maintains a central control file of all books and bound journals on loan to patrons, libraries, or at the bindery.

Daily circulation transaction cards are converted to tape and sorted by borrowers' SSN's. Borrowers' numbers are checked against the Patron File, the transaction is checked for validity, and incoming TX is formatted for further processing. Two error tapes are generated: one for printing and one for punching cards. Valid transactions are written on a third tape.

Valid transactions are sorted by Library of Congress number and posted to both the Book Circulation File and the Book Inventory File. Recall and renewal notices are taped, then sorted by mailing address prior to printing. All items are taped to be printed in sequence by Library of Congress number, then sorted and printed in patron name sequence. Issue slips are taped, sorted by patron name, and printed Weekly and monthly circulation statistics are generated. To provide for the recall of books for reclassification, overdue books, or those needed by another patron, a number of special notices are printed as necessary.

(6) Subject Heading Update Module

This module maintains a central control file of subject headings for books.

Additions, changes, and deletions are sorted by control number, card number and action code, printed and posted to the Subject Heading File. A list of all subject headings is made for reference; and a second printout, showing control numbers, is made and used for file maintenance.

(7) Book Cataloging Module

The Book Cataloging Module maintains a central control

file of bibliographic data for catalog book holdings. It is designed to run weekly and will be operational in 1966.

Primary input to the system will consist of (1) bibliographic data for new holdings; (2) deletions, additions, or changes to existing holdings; or (3) total deletions of bibliographic data.

The system features authority checks on all incoming Library of Congress numbers and subject headings.

The first computer run will validate the Library of Congress numbers, data element codes, data elements, action codes, and other data. It will create a unit record for all valid data elements from the raw input data and reformat each Library of Congress number into a machine sortable form.

Run 2 will sort the valid records into sequence by Library of Congress number.

Run 3 will update the Master Book File and Book Inventory File once the Library of Congress numbers have been checked for authenticity. Subject heading transactions will be selected and written onto a tape for updating the Search Master File in Run 6. New accessions to the Library will be flagged daily, and once a week the program will extract from the flagged records the information needed to produce the Weekly Accessions List.

Run 4 will format the Weekly New Accessions into machine sortable form.

Run 5 will sort the New Accessions into COSATI Code sequence (a print run will follow).

Run 6 will post new subject headings to the Subject Heading Master File, and to the Search Master. At this time, feedback transaction will be prepared to delete any subject headings that were assigned in error. New subject headings will be flagged, selected, validated, and written for display in a cumulative manner.

In runs 1, 3, and 6, records found to be in error will be flagged with an appropriate error message and formatted for print.

IV. EQUIPMENT, COSTS, AND EVALUATIONS

1. EQUIPMENT

At the Library:

- o IBM 632 electronic typing calculator.
- o IBM 026 keypunches (4)

At the Computer Center:

IBM 7090

This computer is owned by the computing center and is used entirely in scientific work. It is not used by ALPHA.

IBM 7010

Three of these computers are rented; two are used exclusively for supply and maintenance support, and the third is for general data processing.

	7010	100 K memory
	2302	disc file
14	729	Mod VI tapes
	716	card reader

IBM 1460

Four of these computers are rented and used for both operational programs and input-output support for the large computers.

	1460	8 K memory
	1402	card readers
2	1403	printers
6	729	Mod VI tapes

IBM 1401

Two of these computers are used for input-output operations.

	1401	8 K memory
	1402	card readers
2	1403	printers

2. COSTS AND TIME

The contractor has had up to four systems analysts working full time on the ALPHA project. Currently there are only two so assigned. With them is a Library Coordinator who is a member of the RSIC staff. Programming is done by the Missile Support Command Computation Center; currently there are three programmers working on ALPHA.

NASA Search is run weekly and uses six to eight hours to answer 25 to 30 queries. The ALPHA system and the NASA Search system together use an average of 50 hours per month on the IBM 7010 and 100 hours per month of IBM 1401/1460 time.

The 18M-632 printing calculator rents for \$395 per month. Computer rental charges are \$145 per hour for the IBM 7010, and \$25 per hour for the IBM 1401/1460. The total library cost of computer rental is from \$9,000 to \$11,000 a month. No operating costs are available because these costs are not separated from the total cost of operating the library.

Approximate running times on the IBM 7010 for the six program modules presently in operation are:

Patron Control	45 minutes
Periodical	45 minutes every 2 weeks
Periodical Routing	18 minutes weekly
Book Order and Receiving	20 minutes daily

Book Circulation	1 - 1/2 hour monthly
Subject Heading Update	1/2 hour

3. EVALUATIONS

The ALPHA project is praised as having made possible a greater volume of library service at a savings in staff time. In 1962, before there were 8,600 users from a potential of 40,000 users, while the library staff had been decreased from 67 to 43 members.

There is a gap between the time a book is borrowed and the time that the weekly printout of circulation is received. During this time, it may not be possible to locate a specific copy of a book or to determine that a patron has returned all books lent to him.

At the beginning of the mechanized circulation system, the staff was insufficiently prepared for the system. Many people were incorrectly or inadequately identified in the record printout. In some instances, the wrong information went into the Patron File itself when the patron was first registered as a borrower. These errors are gradually being corrected by checking against the official lists of employees. In the case of errors made in keypunching the circulation card, these cannot be eliminated without verification of the cards, and the expense and time required for verification are not justified.

The following evaluation was taken from the brochure "ALPHA,
Redstone Scientific Information Center, Redstone Arsenal, Alabama,
June 1965. "

"We realize that initial progress could have been faster had we been willing to settle for less thoroughly integrated systems than we seek or for those which would be forever limited by fixed field records and single character sets of 64 symbols or less. We were not and we are not.

"The RSIC mechanization experience seems to bear out many of the conclusions of White (Sci. Tech. News 18, No. 2, 23-6 (1964). Two additional comments, however, seem to be in order:

1. Really effective, sophisticated information systems require the best in cooperative efforts of imaginative information workers and systems designers. Neither one can do it alone.
2. Significant hardware changes must be made in medium-scale computers to meet the information system challenge. These changes in main frames alone include improved scans, better applications to variable and free-form records, identifications of almost equal or similar but not equal, and simultaneous multiple compares. Mammoth, directly accessible files, cheap multiple remote stations, and more flexible low cost output devices are peripherals which must also be available.

"In developing ALPHA, the almost axiomatic principles of good systems design were kept in mind.

"Three of these deserve emphasis: what we call openendedness, the hopper approach, and the use of feedback loops of machine data.

"ALPHA must be able to accept data from other systems as freely as formats and conversion routines will permit.

"The hopper concept permits us to maintain and update without batching by transaction types.

"Extensive use of feedback loops of machine and man readable output is made. This output later became input in such functions as reordering, etc."

Bibliography

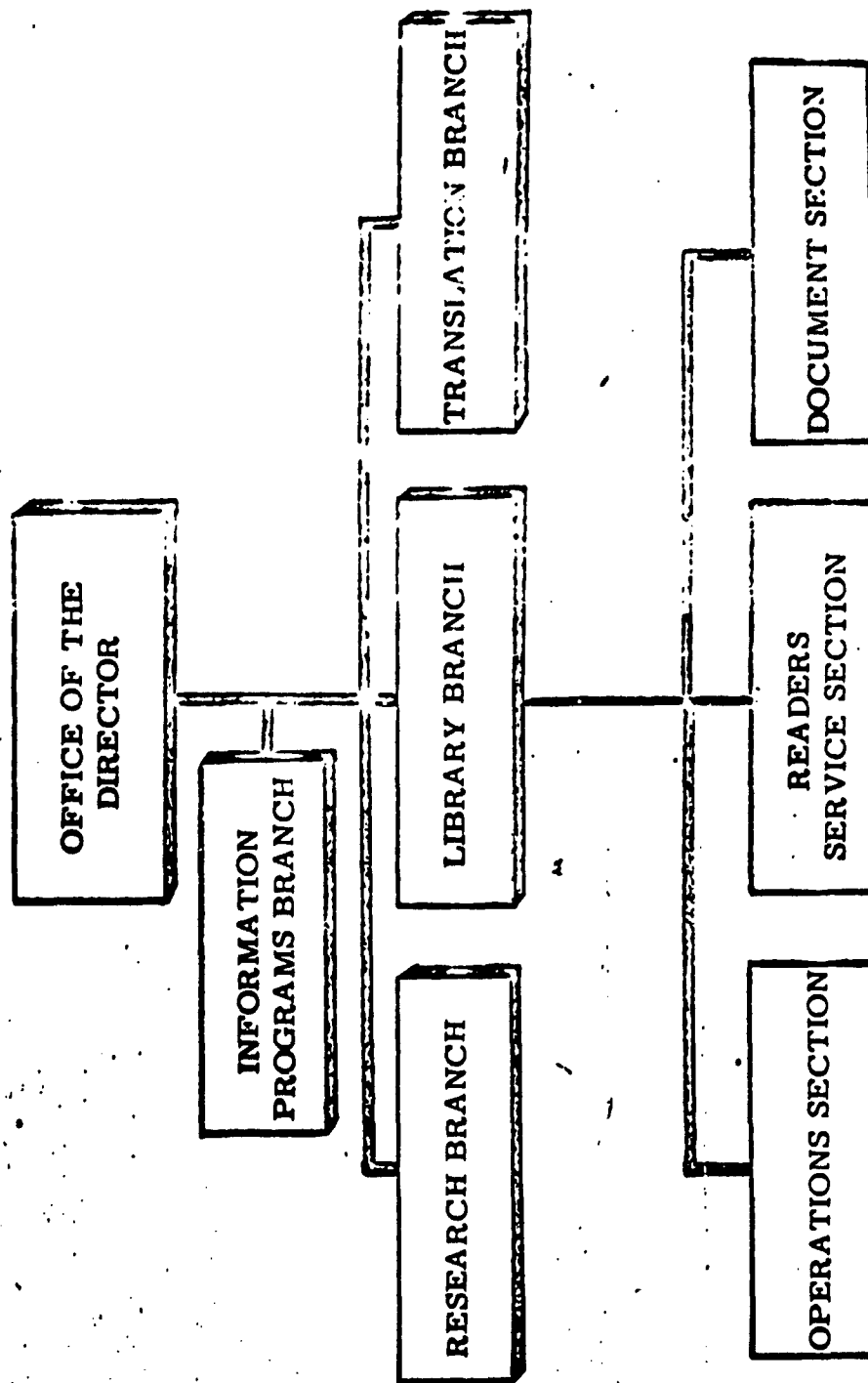
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 - (2) Interim Book Control Subsystem, Circulation Control, Station Operation Procedures, June 1965.
 - (3) Patron Control System, User Procedures and Input Preparation, July 1965
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APPENDIX A

ORGANIZATION CHART

ORGANIZATION CHART

REDSTONE SCIENTIFIC INFORMATION CENTER



APPENDIX B

SAMPLES OF OUTPUTS

9 MAR 66
PATRON NAME

AUTHOR/TITLE

RSIC CIRCULATION LIST IN PATRON PA
SOCIAL PHONE MAIL
SECURITY NUMBER SYMBOL
CALL NUMBER

BACHMAN, M. N. SKOLNIK INTRO RADAR SYSTEMS	579-40-6870 TK 6575	876-7266 AMSMI-YMS S628 1962	
BACKER, M. S. CHAMBERS TECH DICT	503-16-8955 603 C 62138	876-1475 AMSMI-YMS	
BACKMAN, H. D. LATHI SIGNALS SYS COMMUN	510-28-9090 TK 5102.5	842-4140 L352 1965	
BAEDER, H. C. HEVEL APPRAISING EXE PERF	416-56-5642 658.312 H 36598	876-7164 R-P+VE	-F
BAGGS, E. T. HARMS PROB SLEEP DREAM CHI FARAGO ITS YOUR MONEY US BUR OF BUDG BUDGET US GOVT KEY PUBLIC OPINION AMER DEMOCR WHITE INTRO STUDY PUB ADMIN TURABIAN MAN WRIT TERM PAPER HOOK RESEARCH PAPER DUPREE SCI IN FED GOVT WEAVER GREAT EXPERIMENT	248-20-0485 BF 723.545 HC 106.5 HJ 2051 HM 261 JK 421 LB 2369 PE 1478 Q 127.U5 TK 424	876-1776 R-ASTR- H288 1964 F219 1964 U5 1964 K44 1961 W585 1955 T929 1955 H781 1962 D942 1957 W363 1965	-1
BAGLEY, B. D. STAND HDBK FOR ELECT ENGRS KITCHEN TRANSISTOR CIRCUIT	421-34-9538 TK 151 TK 7872.773	876-1470 R-ASTR- S785 1957 F546 1962	-1
BAGLEY, H. D. GLOSSARY OF METEOROLOGY	422-56-8405 QC 854	877-2455 AMSMI-YAM G563 1959	
BAGLEY, L. L. MARCUS ELEMENTS OF RADIO MARCUS ELEMENTS OF TV SERVICING	267-26-1842 621.384 M 45814 621.3883 M 49453	876-7236 AMCPM-YAM	
BAGLEY, M. L. CASSELLS FREN DICT FRY LIB ORG + MGMT OF TECH WENTWORTH PLANE SPHERICAL TRIGONOMETRY ANTENNA ENG HANDBOOK HEFLIN AEROSPACE GLOSSARY DICT OF GUIDED MISSILES + SP FLI LEGALLEY PROC 5TH BAL MISS + SP TEC LEGALLEY PROC 5TH BAL MISS + SP TEC LEGALLEY PROC 5TH BAL MISS + SP TEC	239-30-4019 PC 2640 Z 695.1S3 514 W 6131 621.384135 A 62738 629.1305 H C.4 629.1388 D 43538 629.4 L 51543 629.4 L 51544 629.4 L 51545	876-4860 AMSMI-YAM C344 1962 F946 1963	
BAGWELL, W. F. VON ALVEN RELIABILITY ENGR MINER HDBK OF ENGRG MATERIALS RAMSEY ARCHITECT GRAPH STAND PENDER ELECTR ENGRS HDBK	296-18-4324 TA 168 TA 403 TH 2031 TK 151	539-7424 ARDE ENARI V945 1964 M664 1955 R183 1956 P397 1950V2	V2

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525C * CONTINUED *

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1 0 9 3 MAR 66

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3 0 1 12 MAR 65

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3X 0 1 12 MAR 65

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2X 0 1 12 MAR 65

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 04 122 EAST 55TH STREET NEW YORK 22 NEW YORK
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 06 01RSIC 4484 N \$8.00 0010 1265 00023 64 0165 J
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13 MAR 66

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PAGE 0003

B-4

007-34-5239 SAUCIER, ALDRIC. CONT(1) US 842-3853. R-P+VE-VOI. BL MIC
 008-26-0502 MERCIER, DAVID R.. NASHA(S) US 876-4112. R-P+VE-AMP. BL 4610
 009-03-7832 HASSELTINE, CARROLL L.. NASHA(S) OG 876-7836. R-AERO-VS. BL 4200
 009-09-8878 BENNETT, RAYMOND P.. ARMY(U) OG 876-0268. AMSMI-RRS. BL 5411
 009-20-9098 BUTLER, RAYMOND D.. NASHA(S) 876-2440. R-ME-A. BL 4712
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12 MAR 66	COMPLETE PATRON LIST	IN NAME	SEQUENCE	PAGE 0002
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CLEARANCE -SECRET-				
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PORT TITLE		
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DESCRIPTIVE NOTES (Type of report and inclusive dates)		
Final Report of on-site survey		
AUTHOR(S) (Last name, first name, initial)		
G. A. Kershaw, D. Crowder, J. E. Davis, E. G. Loges, E. Merendini, S. M. Thomas		
PORT DATE	7A. TOTAL NO. OF PAGES	7B. NO. OF PAGES
September 1966	58	2
CONTRACT OR GRANT NO.	9A. ORIGINATOR'S REPORT NUMBER(S)	
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ABSTRACT		
<p>The Redstone Scientific Information Center (RSIC) is engaged in a major effort to mechanize its Library operations using 3M 7010, 1460, and 1401 computers. The total integrated effort is known as ALPHA (Automated Literature Processing, Handling and Analysis System), which is a serial system operating on a batched transaction basis. The system is in first-generation stage of development. Mechanization of RSIC is being developed under contract by General Electric. At present, the mechanized routines for the acquisition and circulation of books, periodical control, and the Patron File are fully operational. RSIC also receives NASA tapes and utilizes them in literature searches. In addition, NASA Headquarters is sponsoring an information automation project in which RSIC is participating. This is a prototype test of the current selective dissemination of information based on IBM's SDI programs. Several programs are being planned or developed for mechanization in addition to the above.</p>		

KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Digital Computers						
Libraries						
Information Retrieval						

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